

Columbus Iron Works, 1853
800-900 Blocks of Front Avenue
Columbus
Muscogee County
Georgia

HAER GA-28

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108-COLM,
22-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

The Columbus Iron Works

HAER GA-28

Location: Columbus, Georgia, Front street,
west side, 800 and 900 blocks.

Construction dates: 1902-1907

Original Owner: The Columbus Iron Works Company

Present Owner: 800 block: City of Columbus
900 block: W. C. Bradley Company

Significance: For over a century (1853-1965) the Columbus Iron Works supplied the city and surrounding area with a wide assortment of cast iron goods, agricultural implements, industrial and building supplies, and steam engines for river boats, saw mills, and other uses. It was organized as a small operation with a single forge and small rolling mill in 1853. The Civil War greatly expanded its capacity. The Confederate government leased the facility in 1862 and under the direction of Chief Engineer James Warner it manufactured boilers and steam engines for at least 14 Confederate gunboats. Although burned by Federal raiders at the end of the war, the company rebuilt immediately, and the experience with boilers and steam engines gave a distinctive feature and separated it from smaller foundries. By 1880 only the Columbus Iron Works manufactured steam engines within Georgia and was one of only sixteen within the South. The company still produced a whole range of cast iron goods and the Southern Plow Company, a division of the Columbus Iron Works, manufactured plows and agricultural implements. Using the expertise involved in fabricating steam engines and boilers, the company produced its most significant product, the ice machine. From 1880 until the 1920s the company's Stratton ammonia-absorption ice machine was the

Significance:
(continued)

most widely marketed ice machine in the nation. From the 1920s until 1965 it remained a diversified manufacturing operation. In 1965 the W. C. Bradley Company absorbed the Columbus Iron Works. The present buildings of the Columbus Iron Works, built between 1902 and 1907 after fire destroyed the earlier buildings on the site, have changed little through the years. The southern half of the old plant is owned by the city of Columbus and is being converted into a convention center, while the northern portion is still owned by the W. C. Bradley Company.

Historians:

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Note: See GA-33, drawing sheets 1 of 13, 2 of 13, 3 of 13 for Front Avenue elevations of buildings and sheet 13 of 13 for site location map and descriptive statement.

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The Columbus Iron Works

For over a century (1853-1965) the Columbus Iron Works supplied the City of Columbus and surrounding area with a wide assortment of cast iron goods, agricultural implements, industrial and building supplies, and steam engines for river boats, saw mills, and other uses. The company helped to pioneer the development of the ammonia absorption ice machine in the early 1880s and successfully marketed ice machines until the late 1920s. Although the ice machines provided the company with a distinctive product, the Columbus Iron Works never moved toward specialization in refrigeration and continued to manufacture a diversity of iron products throughout its existence as a corporation.

While maintaining a continuity of products, the history of the company can be periodized into 5 distinct phases: (1) the small antebellum operation, (2) the Civil War, which intensified its production and ultimately destroyed the plant, (3) the postwar period ending in 1902 when fire again destroyed most of the facility, (4) the Teague ownership (1902-1925), and (5) the Bradley ownership until 1965 when the W. C. Bradley Company moved its operations to another location.

The Antebellum Period

By the 1840s several small foundries operated within Columbus and at least two of them appear to be predecessors of the Columbus Iron Works. In 1846 the Columbus Iron Foundry advertised the sale of "iron casting of every description . . . mill irons, gin gears, plough-points, friction rollers, cotton press castings, and the Hotchkiss patent water wheel of various sizes and patterns." By 1849, William R. Brown and Company operated the Columbus Iron Foundry at Front Avenue north of 9th Street, annually producing \$8,000 to \$10,000 worth of "steamboat work, mill gearing, water wheels, gin gearing and gudgeons, cast iron railing for grave-yards, and fencing machinery for factories, etc." These foundries utilized steam engines for their power. [1]

William R. Brown organized the larger Columbus Iron Works in 1853 and served in 1856 as one of its incorporators along with Harvey Hall, Isaac J. Moses, Jacob Hendricks, and William A. Beach. The occupations of the founders help to define the products manufactured by the iron works. Both Moses and Beach participated in the hardware business and presumably retailed small stoves, skillets, and other cast iron goods. One of Hall's business concerns was steamboating and the river trade. [2] Also, the location of the Columbus Iron Works, only a block east of the steamboat landing, reflected its close and continuing relationship with the river. The iron works produced steam engines, decorative grill work, and other iron material for the river boats, which carried the foundry's other products to its principal market outside of Columbus, the prospering agricultural region down the river.

In its early years, the Columbus Iron Works manufactured the same types of products as its forerunners, and it remained a relatively limited operation with a single forge and a small rolling mill. [3] In 1860 Columbus ranked fifth in the production of iron goods among the five urban areas in Georgia (See Table I). Although the census data contained some inaccuracies (it showed no cast iron production in Muscogee County), Columbus was not a major iron manufacturing center in 1860. In part Columbus' youthfulness (it was established in 1828), accounted for its position relative to other Georgia cities, but probably more important, the Columbus foundries served a much smaller market. The Civil War greatly increased the demand for iron throughout the Confederacy and as a result, production in Columbus expanded.

The Civil War

The Columbus Iron Works made a significant contribution to the Confederacy, but as with so much about the Civil War, the company's contribution has been embellished and enshrouded with myths and legends. As early as July 1861 the company cast two 3 inch artillery pieces for local military companies. By late 1861 the works produced larger cannons under contracts with the Ordnance Department. In January of 1862 the Columbus Enquirer visited "the extensive establishment" and "found brass twelve-pounders for throwing round shot, mortars of the same calibre, and a wrought iron rifled cannon. The perfect casting and beautiful finish of these heavy guns must elicit the surprise and admiration of all who see them . . ." [4]

Other iron working facilities within the city shifted to the production of ordnance. Building on a small antebellum tinsmith shop, Louis Haiman and Broth eventually became the largest sword manufactory in the Confederacy. In 1863 Haiman began producing copies of the Colt Navy pistol. Two other individuals, J.P. Murray and John D. Crey, manufactured rifles within the city. The industrial activity in Columbus led the Ordnance Department to establish in June of 1862 the Columbus Arsenal with equipment evacuated from Baton Rouge. The new arsenal replaced the Columbus Iron Works as the major producer of cannons and ammunition within the city. [5]

After early 1862 the Iron Works might have produced a few cannons and shot, but increasingly it concentrated on its most significant product, steam engines and boilers for gun boats. Apparently the Columbus Iron Works supplied a few of these to the Confederate Navy during 1861, and in June of 1862 the government leased the facility, converting it to the C.S. Naval Iron Works. James H. Warner, formerly Chief Engineer of US Navy Yard at Gosport, Virginia, took charge of the facility, added a large boiler factory, installed machinery evacuated from Gosport, and began manufacturing several different types of steam engines. [6]

The surviving portions of the engines and installation drawings indicate that one style of their non-condensing engines ran at a low 15 pounds of pressure, probably to avoid a large explosion if an enemy shell penetrated the boilers. Its double-acting 28 inch cylinder (34 1/2 inches outside

TABLE I: IRON FABRICATION IN GEORGIA'S FIVE URBAN COUNTIES, 1860

(Measured by the value of the product)

COUNTIES	PRODUCTS			TIN, COPPER, SHEET IRON WARE
	MACHINERY, STEAM ENGINES & ETC.	IRON, RAILROAD	IRON CASTINGS	
BIBB (Macon)	\$155,000	none reported	none reported	\$46,266
CHATHAM (Savannah)	\$182,450	none reported	\$81,000	none reported
FULTON (Atlanta)	\$212,853	\$137,230	none reported	\$18,303
MUSCOGEE (Columbus)	\$48,000	none reported	none reported	none reported
RICHMOND (Augusta)	\$79,175	none reported	\$30,000	none reported

(From Manufactures by Counties, 1860 (Georgia), in Manufactures of the United States, Eighth U. S. Census, 61-81)

diameter) developed 40 revolutions per minute with a stroke of approximately 1 foot 8 inches. Two such engines powered most boats. [7]

Engines manufactured at the Iron Works during the war drove at least 14 gunboats of various sizes, and one civilian steamboat. Additional Confederate boats utilized iron fittings, boilers, and other machinery fabricated at the C.S. Naval Iron Works. [8] The famous gunboats built in Columbus during the war were not constructed by the Irons Works, but by the Confederate Navy Yard, an entirely different entity. The Yard's commander, Lieutenant Andrew McLoughlin, reported directly to the Secretary of the Navy, Stephen R. Mallory, and he and Warner were equals, with McLoughlin supervising the design and construction of the boats, and Warner having responsibility for the power plants. The Navy Yard produced two boats: The Chattahoochee and the Muscogee (also known as the ram Jackson). After being launched in early 1864 the former's inexperienced crew exploded its boilers before reaching the Gulf. The Chattahoochee, which had returned for new boilers, and the still incomplete Muscogee were both captured and burned by federal troops in 1865. [9]

Work at the Iron Works and the Navy Yard slowed in 1864 as a result of shortages of raw materials and because of General William T. Sherman's invasion of the state. The state militia mobilized the white workers in the Iron Works and Navy Yard who were considered part of the home defense units and sent them first to Macon and then to Savannah in a fruitless attempt to stop Sherman. After the fall of Savannah, they returned to Columbus to defend it against General James Wilson's approach from the west in the spring of 1865. Warner tried to move his operation to a safer location down the river. His primary effort focused on saving a partially constructed, large rolling mill capable of producing armor plate. All the armor plate for the Columbus gunboats previously came from Atlanta. In April Warner sailed down the Chattahoochee to reconnoiter new sites and returned to Columbus to find his facility in ashes. He arrived in time to see the end of General Wilson's column disappearing over the eastern hills. [10]

The C. S. Naval Iron Works made a significant contribution to the Confederacy, and the war in turn affected the future development of the Columbus Iron Works. The Techniques Warner taught Columbus craftsmen for making boilers and boring cylinders enabled the post-war company to produce steam engines and eventually ice machines. That capacity gave the company its distinctive feature and separated it from the average iron foundry. After Warner's death in February of 1866, the men he had trained continued to be active within Columbus. George J. Golden served as superintendent as the mechanical genius within the company until his death in 1880. [11]

The Post-War Period

The war's stimulating effect on iron fabrication in Columbus was felt for some years afterward. Not only the Columbus Iron Works staff but many other individuals who learned new skills during the war tried to continue in the iron trade. In May of 1865 -- only one month after being destroyed

by Wilson -- the City Foundry advertised its readiness to manufacture sugar mills, syrup kettles, bark mills, gin gearing, hollow ware, pots, ovens, and skillets in exchange "for any kind of country produce." During the late 1860s and early 1870s as many as eight foundries competed with each other, frequently changing their names and properties. [12]

The 1870 census reflected the growth of iron fabrication in Columbus compared to other Georgia cities. In 1860 Muscogee produced less than any of the four other major cities, but by 1870 the value of its tin, copper and sheet iron work led all the other counties and the volume of its iron castings ranked second to Atlanta (See Table II). These statistics reflect the output of all the small foundries, but without the artificial demand of the war their market was too limited to sustain them all; many failed or were reduced to small operations. The value of iron fabrication in Muscogee County soon shrank back to the 1860 level when measured against its sister cities (See Table III). The Columbus Iron Works remained as the city's most stable and most prosperous concern within the field and the only foundry and machine shop in the city.

Post-War Products and Physical Plant

The stockholders of the Columbus Iron Works met after the war and doubled the company's capitalization, showing their optimism about the industrial future of the city. The Iron Works resumed operations by the end of August 1866 with William Riley Brown still serving as president of the company and George Golden as its superintendent. As the largest foundry in the city, it apparently absorbed personnel from the smaller operations as they went out of business. Initially the Iron Works avoided competing with the smaller manufacturers, who produced little stoves, skillets, and other hollow ware for domestic use. Instead, the Iron Works concentrated on filling the needs of the planters, local industries, and the river boats [13] (CIW photo 1).

The Columbus Iron Works produced saw mills, syrup kettles, sugar mills, three types of iron screws for baling cotton, bark mills, and a variety of plows and other agricultural implements. In 1877 the company organized the Southern Plow Company as an internal organization within the larger concern. After the war Louis Haiman, the sword maker, organized the large and successful Southern Agricultural Works in Columbus, but in 1876 he moved the operation to Atlanta. Perhaps the Southern Plow Company was formed to fill the void left by Haiman's departure.

The Southern Plow Company occupied the buildings in the 900 block of Front Street, or the upper half of the plant. An Enquirer reporter visited the works one night in 1877 and recorded its activity as a "beautiful and engaging sight." Workmen started with pre-cut iron plates, sheared them to the general shape of the plow point, and punched the necessary hole. Then after heating the point in a coke fire to a red heat, another worker used a trip hammer to shape the point. A vertical cutting knife cut the

TABLE II: IRON FABRICATION IN GEORGIA'S FIVE URBAN COUNTIES, 1870

(Measured by the value of the product)

COUNTIES	PRODUCTS		
	IRON CASTINGS	MACHINERY	TIN, COPPER & SHEET IRON
BIBB (Macon)	\$65,900	\$99,050 not specified 32,600 cotton & woolen 274,216 railroad repair	\$22,412
CHATHAM (Savannah)	\$83,000	\$409,6600	\$10,050
FULTON (Atlanta)	\$18,000 \$750,000 forged & rolled	\$40,000	\$29,500
MUSCOGEE (Columbus)	\$102,947 not specified 16,400 stoves and heaters	\$61,992 engines & boilers \$34,500 cotton & woolen	\$30,150
RICHMOND (Augusta)	\$39,500	\$60,140 not specified \$270,196 railroad repair	\$14,500

(From "The State of Georgia," Table XI, in The Statistics of
Manufactures, 1870, Ninth U. S. Census, 064-48.)

TABLE III: IRON FABRICATION IN GEORGIA'S FIVE URBAN COUNTIES, 1880

(Measured by the value of the product)

COUNTIES	PRODUCTS		
	AGRICULTURAL IMPLEMENTS	FOUNDRY & MACHINE SHOP	TIN, COPPER & SHEET IRON WARE
BIBB (Macon)	none reported	\$202,500	\$33,394
CHATHAM (Savannah)	none reported		\$46,000
FULTON (Atlanta)	\$380,000	\$252,908	\$127,900
MUSCOGEE (Columbus)	\$60,118	\$82,179	\$23,930
RICHMOND (Augusta)	none reported	\$146,250	\$27,700

(From Selected Statistics of Manufacturing by Counties, etc.: 1880,
in Tenth Census, 1880, Report of the Manufacturers of the United
States, 207-10.)

irregularities from the edge and then the entire point was heated white hot in another coke fire. Another powerful forging hammer formed the plow into the final desired shape. Two different emery wheels polished and finished the products. Under the supervision of George Golden this factory turned out 160 plows per hour. By 1880, 36 employees manufactured an annual product of \$60,118. The process remained almost the same for seventy years, and as long as the company produced plows, they were made in the same location, along the northern wall of the 901 building. [14]

The foundry and its 20 molders produced the metal parts for the plow factory and other operations and was located in the southern buildings of the plant. The company occupied the entire western half of the 800 block of Front Street (see CIW Site plan, Columbus Drawing #12) and the foundry operated within the middle of the space (north of its present location). The foundry cast hundreds of items utilized by other industries, especially parts for power transmission. The Columbus Iron Works from the late 1860s until 1902 sold water wheels, turbines, shafting, hangers, pulleys, 54 different spur wheel and pinion gears, 14 spur mortise wheels and pinions, 14 styles of spur segment gears, 26 bevel wheels and pinions, 8 mitre wheel patterns, and 7 gin gear and pinion patterns, flour mills, and grist mills. City Mills and Empire Mills, local grist mills, bought Iron Works products, as did large textile firms such as the Eagle and Phenix, and Muscogee Mills. [15]

The Iron Works also furnished industries and builders with sawn and planed lumber. The company ran a 75 horsepower steam engine of its own construction to power various facets of its foundry and forge operations. Metal working aspects failed to use all of the engine's energy, and the finishing of lumber represented a logical extension, particularly since the plant was located next to the steamboat dock. The company also kept on hand a great variety of pipes, fittings, elbows, stopcocks, globes, and whistles. The Iron Works manufactured some of these items, but for many the company simply acted as a wholesaler. By 1887 they also retailed incandescent lamp plants, consisting of a generator and 100 lights, for the U. S. Lighting Company. The company thus provided many necessary services to the expanding industrial economy of the city. [16]

George Golden, using the skills acquired during the war, developed and manufactured steam engines (5 to 100 horsepower) for use on plantations, railroads, and the river. In 1870 the Columbus Iron Works supplied 12 horsepower steam engines for the Central of Georgia Railroad, to pump water and saw wood at all their stations. Golden also made and installed the engines in the Rebecca Everingham, the largest river boat (592.20 tons) built in Columbus during the period. The cylinders of its two engines measured 10 1/4 inches in diameter, with a 4 foot 16 inch stroke, and developed a pressure of 183 pounds. In 1880 the Columbus Iron Works was the only manufacturer of steam engines in Georgia and one of 16 within the South. [17] The experience with steam boilers and the boring of cylinders allowed the Columbus Iron Works to be an early and successful manufacturer of artificial ice machines.

The Artificial Ice Machine

As in the case of the Civil War, the pioneering role of the Columbus Iron Works in developing the ice machine has become shrouded in legend. Company historians proclaim that the Columbus Iron Works built the first commercial ice machine. Proving such a claim would be impossible; with such a multiplicity of machines, companies, and individuals, no one could identify precisely the first commercially successful machine. However, the Columbus Iron Works' Stratton absorption ice machine was probably the most successfully marketed machine for thirty years after its introduction in the 1880s.

The potential market for ice within the South had always been large, and prior to the Civil War expensive natural ice shipped from the North found a limited demand. The developer of a cheap artificial ice machine could reap a fortune and during the late 1860's, according to a trade history, "tireless experimenters" invaded the South, all trying to perfect the process. The Columbus Ice Manufacturing Company unsuccessfully tried to raise enough capital to erect an ice plant in 1865 and again in 1868. On both occasions, the local newspapers attempted to chide local investors by pointing out the success of ice machines in other southern cities. By 1869 at least four plants in the U. S. manufactured ice for sale. [18]

In 1872 the first successful ice machine began operating in Columbus. In the spring of that year Golden traveled to New Orleans and observed an Andrew Muhl compression-type machine that used ether as a refrigerant. By the fall the Columbus Iron Works had built such a machine at the cost of \$15,000. In its first night of operation it froze 1500 pounds of ice in 25 pound cakes. The investors planned to erect a factory at the site of the old Carter Factory on the river (on Eagle & Phenix property) and manufacture and sell ice machines for \$9,000 apiece. Construction of the new factory never began. The Columbus Iron Works continued to manufacture a few of these models and sold them in Montgomery, Texas and in Cuba. Muhl demanded royalties and the Columbus Iron Works stopped making his machines. [19]

The company's real success in the field came after 1880 as a result of the association with H. D. Stratton. In 1874 as a student at the Franklin Institute in Philadelphia, Stratton chanced upon an article dealing with the future possibilities of the ice machine industry and became intrigued by the possibilities. The patents on the earlier Carre Model ammonia absorption machines were soon to expire. With that starting point Stratton built his improved ammonia-absorption system in 1876 and improved it until 1879 when he brought a 3 ton (daily ice capacity) machine to Columbus. He installed this ice maker at the site of the present Muscogee Ice Company (1902). He added another similar machine to the plant in 1879-1880 as demand for the ice increased. Before completing the installation of the second machine by the Columbus Iron Works, Stratton sold the plant to the newly organized Columbus Ice and Refrigeration Company. [20]

Stratton formed a partnership with the CIW in 1883 "for building and introducing" his machines under the name of the Stratton Improved Absorption Ice Machine. The company built numerous machines with capacities ranging from 3-30 tons of ice a day and sold them widely in the south and into the midwest and Pennsylvania. Stratton's earlier machine produced 10x14x14 inch blocks, each weighing 100 pounds. In 1884 an H. D. Stratton and Company machine was shown at the New Orleans Cotton Exhibition. This one produced ice blocks 14x14x32 inches weighing 200 lbs. It was claimed that this was the "first machine to make ice so thick and of so clear a quality." It produced distilled water ice of such high quality of appearance that its ice became a "standard of excellence in later years for the raw water product." [21]

By 1887 the Columbus Iron Works had sold 35 of Stratton's machines, 12 during that year. The company erected and installed the machine for the buyer, charged it with ammonia and brine, and then tested it before turning it over to the purchaser. Stratton retired from the company in 1891 to manage his various ice plants in the East and headquartered himself in Philadelphia at a plant erected by the Columbus Iron Works. [22]

After Stratton left Columbus Iron Works continued to build and market the machine under the name: "The Columbus Improved Absorption Ice Machine" (CIW photo 2). By 1900 they had installed 146 of these machines. This line was continued practically unimproved until at least 1921. By 1924 CIW had introduced a modern Ice-Refrigerate machine which ran the compression process that "incorporated the latest principles of the art." This line was continued at least through 1929. [23]

An index to company plans and drawings indicates the geographic distribution of these ice machines (See Table IV). This source lists all the plans prepared by the Company from about 1900 to 1930. Most of them deal with installing ice machines and so offer a general idea about the size of the company's market. [24] Although the Iron Works served chiefly the South, several northern midwestern cities purchased machines from Columbus.

In 1929, while considering "Twenty-five Years of Ice Manufacture in the South," C. T. Baker wrote: "To the builders of this earlier type of absorption ice making machinery (H. D. Stratton), the Southland is greatly indebted, since as already pointed out, this company (The Columbus Iron Works) has contributed greatly to the growth of the industry and in no small measure is credit due to them for the building of the foundation upon which the ice and coal storage industry of the South rests today." [25] Though not producers of the first ice machine, the Columbus Iron Works was the most successful marketer of the ammonia absorption machine for thirty years.

TABLE IV: DISTRIBUTION OF CITIES WHERE THE COLUMBUS IRON
WORKS INSTALLED EQUIPMENT, 1900 - 1930

STATE	NUMBER OF CITIES	STATE	NUMBER OF CITIES	STATE	NUMBER OF CITIES
Georgia	78	Louisiana	5	West Virginia	2
Alabama	50	Indiana	4	Illinois	2
Florida	44	Ohio	4	Colorado	1
Mississippi	15	Pennsylvania	4	Oklahoma (Indian Terr.)	1
North Carolina	12	Tennessee	4	Missouri	1
South Carolina	10	Texas	4	*Ontario	1
Virginia	8	*Cuba	3		
Arkansas	7	Kentucky	2		

(Source: Index to Plans and Drawing, 1900-1930, Columbus Iron Works Records)

The Teague Ownership (1902-1925)

The company suffered from two tragedies in 1902. On 28 March 1902 William R. Brown died and on 11 April the Iron Works burned. In the city's largest fire (excepting General Wilson's burning of the city), the company suffered a \$200,000 loss; everything burned except the new plow handle factory west of the Southern Plow Company building and the new foundry at the extreme southern end of the property. [26]

In the same year the Teague family of Montgomery, who had already been involved in the company, purchased control of the firm, and A. J. Teague became its president. At that point the company had several options. Building on the base established by Stratton, it might have specialized in refrigeration. Although they continued to make ice machines until the 1920s this product line lagged somewhat. Their last advertisement in Ice and Refrigeration appeared in March of 1904. The refrigeration industry went in the direction of smaller units. The Columbus Iron Works failed to follow, and eventually its ice machines became obsolete. Instead of specializing, the company continued its diversified product line, in part perhaps because it dove-tailed with the wholesale hardware interests of the Teagues in Montgomery, but also because of the need for such an undifferentiated business within Columbus. Also, transportation considerations made it difficult for Columbus to compete within a national market.

The Rebuilt Plant

Between 1903 and 1907 the entire plant of the Columbus Iron Works was completely reconstructed, and remained the same, with minor changes, as long as it operated (See CIW Site Plan, Drawing #12). The Southern Plow Company again occupied the upper wing of the two east-west portions of the 901 building. The rebuilding of this structure included the addition of its distinctive round windows (CIW photos 3, 4), which also appeared on the newly built powerhouse (see section on "1902 Power House").

Inside the building, plow production moved from west to east, where a row of Bradley hammers shaped the plow points (CIW photos 5 & 6), which were then painted along the eastern wall. In the lower east-west bay workers assembled the metal and the wooden parts, which came from the handle factory to the west. Other metal products were also assembled and painted there (CIW photos 7 & 8). The 901 building housed the offices for both the Columbus Iron Works and the Southern Plow Company.

In the southern portion of the plant, a row of contiguous buildings stood along the western property line (CIW photos 9 & 10). They housed, going north to south, a power house, a planing mill, a sash and blind factory, and the machine shop (300 x 100 feet) that extended to Front

Avenue (CIW photos 11 & 12). Then came a cleaning room, a boiler and tin shop, and the foundry which originally stretched eastward across 3/4 of the block. An addition in the late 1920s extended it to its present 300-foot length [27] (CIW photos 13 and 14).

The foundry represented the heart of the operation of the Columbus Iron Works. The process there changed very little from 1902 until it stopped operating in the 1970s, despite changes in the products molded. Originally two cupola furnaces (later only one) provided the molten iron (CIW photos 15 & 16). The molders (24 of them by the late 1930s) started each morning with a windrow of damp sand. Initially using a bench with wheels and later a molding machine, the molders riddled the sand to clear it of bits of metal. They filled the bottom half of the form with sand and inserted the pattern. After filling the forms, or logs, and compressing the sand, they separated the top and the bottom, removed the pattern and reassembled the two halves. As the molders worked down the windrow they left three or four rows of molds. By the afternoon the iron started flowing from the cupola, and originally the molder carried the iron maybe 35 yards to his floor area. Later a bull ladle on an overhead trolley delivered the iron to the front of each floor. The molder poured his molds and then two men called "shake-outs" broke the castings out of the sand. After watering the sand with sprinkler cans, several workmen "cut" the sand with shovels throwing it back into a windrow, ready for the next day [28] (See CIW photos 17, 18, 19, 20, 21 for depiction of process).

In the next northern portion of the plant, tumbling mills smoothed and finished the cast iron items (See photo 22). Parts then passed to the large machine shop where another group of workers assembled the parts of ice machines and stoves into a final product. Prior to 1940 each worker produced a complete product, after carrying all the various portions to his station. After that date a type of roller conveyer resulted in a continuous process with each laborer performing a specific function. This large building housed the machinery used in boring steam engines and compression cylinders (CIW photo 23).

The machine shop housed a variety of products and services. In addition to assembling the previously mentioned items, such as steam engines and stoves, the Columbus Iron Works manufactured and machined lathes and lathe beds for the American Machine Company. The company also supplied many valves and pipes for the New York City water works, because one of its superintendents had earlier worked for the Columbus Iron Works. Before the Central of Georgia built extensive shops in Columbus, steam locomotives were repaired in the machine shop area. [29]

The 1902 Power House and the Evolution of CIW Power Supply

When rebuilding the plant in 1902, the directors of the company decided to furnish their own supply of electricity. Although the two power companies in town (the Columbus Railroad Company and the Columbus Power Company) tried to convince them otherwise, the unreliability of central station service in the past helped to convince the Iron Works to build their own power plant (CIW photo 24). Also, at that time direct current motors functioned more satisfactorily for the needs of the Iron Works than did alternating current. The power companies only supplied the latter; use of their power would necessitate a conversion.

In the power house a 500-horsepower Corliss steam engine with a 36-inch piston and a 22-foot fly major producer of large engines and did not attempt to use one of their own construction. The boilers generating steam for the engine consumed a carload of coal every day as well as shavings blown from the handle factory, and coke produced by the gas company in the process of manufacturing gas. Steam from these boilers also drove hammers and other equipment motivated by steam pressure. [30]

The Corliss engine turned, by means of a wide belt, two horizontal direct current generators (200 horsepower each). Those generators provided current for two 50-horsepower and one 25-horsepower motor in the plow shop forge, one of 75-horsepower in the handle factory, and a 10-horsepower motor in the plow finishing and painting area. The plow warehouse area utilized a 10-horsepower motor, and one of 15-horsepower operated in the machine repair portion of the handle factory.

In the southern portion of the plant, the generators drove a 90-horsepower motor in the planing mill and a 25-horsepower one in the sash and blind factory. Two 25-horsepower motors drove line shafting on both the north and south sides of the machine shop. None of the line shafting extended from one room to another or from one operation to another. The individual electric motors allowed the company to run each operation separately -- an important consideration in such a diversified manufacturing concern. [31]

Gradually alternating current motors replaced the original ones as improvements came in both service of the power company and the capabilities of alternating current motors. By 1929 central station alternating current drove all the motors in the southern portion of the plant except for those running the large overhead cranes in the machine shop and foundry. The new motors tended to be more powerful than the originals. During the "Hoover Flood" of 1929, water entered the power house and necessitated additional refurbishing of the equipment. The Columbus Electric and Power Company, after years of urging, finally convinced the company to completely abandon its steam engine. [32]

The power company provided the Iron Works with a 320-horsepower synchronous motor, which the power company also utilized as a power factor corrector for their lines. The new motor drove the old northern generator which in turn powered the remaining D.C. motors in the plow shop and on the cranes in the two southern bays. Such motor-generators were commonly used to convert A.C. to D.C. An air compressor replaced the second, or southern, generator (CIW photos 25 & 26). The new air compressor pneumatically powered all the equipment formerly employing steam pressure.

This arrangement of an A.C. motor driving both a D.C. generator and an air compressor continued until 1960. In 1946 individual A.C. motors replaced the large D.C. motors and line shafting in the plow shop. After that time the D.C. generator, which drove only the two cranes, ran with less frequency than the air compressor. In 1960 2 smaller motors replaced the large synchronous motor. A 50-horsepower motor turned the D.C. generator while one of 75-horsepower powered the air compressor. The air compressor no longer functions, but the A.C. motor could still turn the D.C. generator that supplies current to the overhead cranes [33] (CIW photos 27 & 28).

W. C. Bradley Ownership (1925-1965)

In 1925 controlling interest in the Columbus Iron Works passed from the Teague family to W. C. Bradley, a prominent local businessman associated with the company for many years. The shift in ownership resulted in very few immediate changes (compare physical plant, CIW photos 29 & 30). The company continued for nearly 40 years to manufacture the same wide variety of items. Gradually it attempted to reduce the number of products and to concentrate on fewer, more marketable items. Since the early 1970s, after being absorbed by the W. C. Bradley Company, the iron fabrication division has specialized in the manufacture of two products: forged cutter blades and aluminum grills. [34]

During the 1920s the manufacture of ice machines, which had gradually declined, was finally terminated. In 1921 the company sold some of its ice machine patents to the New York Corporation. In 1927 in order to provide tonnage for the foundry the company began casting iron stoves and heaters. These coal and wood burners were sold within the city and in the rural areas of southern Alabama and Georgia. In 1929 the company tried to market an expensive gas room heater, but the depression hampered this effort. [35]

The impact of World War II on production at the Columbus Iron Works was not discussed in the sources available. Immediately after the war, however, in 1946 the company modernized the Southern Plow Company shop, building a more substantial roof over the center east-west bay of the 901 building, paving the floor, and replacing the D.C. motors and the line shafting with individual A.C. motors (CIW photos 31 & 32).

The rural areas south of Columbus formed the primary market of the Southern Plow Company. After World War II the erosion of that market began to accelerate. The consolidation of farms into larger units replaced many mules and plows with tractors. The refurbished plow shop, facing shifting and uncertain demand, entered the tractor drawn implement business, manufacturing plows, disc harrows, and land levelers. A drop forge operation, purchased in the early 1950s from Atlantic Steel in Atlanta, supplemented implement production and also manufactured component parts for the equipment of name brand manufacturers.

Unfortunately, the company's tractor-drawn implements never really found an adequate market. At the time the Columbus Iron Works moved into that field, the major producers of tractors such as John Deere, Ferguson, Ford and others, expanded their operations and erected larger plants to manufacture all of their accessories for their equipment. By the late 1960s the Bushhog Company had purchased from the Iron Works the tractor-portion of the business. In the early 1970s the Leisure Group, a West Coast conglomerate, bought what remained of the Southern Plow Company. [36]

After World War II, electricity and propane gas replaced the cast iron stoves and heaters in most areas supplied by the Iron Works foundry, creating uncertainty for this division of the company's operations. The Iron Works needed to replenish the foundry's dwindling volume of work and in the late 1940s began experimenting with barbeque grills. During 1953 the foundry manufactured its first covered barbeque grill, which sold under the name of Char-Broil and became its most successful product. Gradually the types of grills shifted from cast iron and sheet metal to aluminum ones. By 1959 the management had separated the manufacture of grills from the cast iron stove business. With its own sales force the Char-Broil became the company's first truly national and eventually inter national product.

In 1965 the W. C. Bradley Company absorbed the Columbus Iron Works into its own corporate structure. The old mill supply division of the Iron Works merged into two other units of the W. C. Bradley Company: a wholesale hardware business, and building materials and electrical supplies. In the early 1970s the W. C. Bradley Company began developing the Bradley Industrial Park in north Columbus. The company constructed a factory there to manufacture modular homes, but after only 9 months of operation the inability to sell the product closed down operations. This failure left an empty, modern building, and the grill operation was moved there in 1972. Now this division produces aluminum grills in mechanical molding machines (until this time, the sand-molding method described earlier had been employed; see CIW photo 33), and manufacturers or sells every type of grill except those made from inexpensive sheet metal. The Bradley Company claims to sell 35% of the covered barbeque grills within this nation and produce grills for many national retailers such as Sears and K-Mart under their brand names. [37]

In the early 1970s the company decided to mechanize its foundry operation process, making the first substantive changes in over 60 years. The new procedure necessitated an underground conveyor system, and the fear of floods from the river was one factor in the decision to move the foundry to Bradley Park and modernize it there. The river, once so important in the location and functioning of the foundry, had become a menace. A new foundry was built at Bradley Park, but was later sold to another firm. Finally, in 1973, the drop forge operation was moved to a building adjacent to the grill manufactory. The forge, in many ways a continuation of the operation purchased from Atlantic Steel, now produces cutter blades for heavy mowing machines (Bushhogs) and similar parts for other implements. [38]

The City of Columbus purchased the southern portion of the old Columbus Iron Works operation and is attempting to convert the foundry, machine shop and connecting bays into a trade and convention center reflecting the industrial nature of the site (CIW photo 34). The northern portion of the plant is still owned by the W. C. Bradley Company and it is studying (with the aid of HAER planning team, summer of 1977) possible adaptive reuse for the 901 building which would dove-tail with the new convention center (CIW photo 35 & 36). As the old Columbus Iron Works was essential to the economy of Columbus in the late 19th and early 20th centuries, now the successful conversion of the Iron Works into a trade center is essential for the revitalization of the downtown area of Columbus.

Footnotes

1. George White, Statistics of the State of Georgia (Savannah, 1849), 477; Columbus Enquirer, 29 December 1846; Scientific American, 29 June 1850, 322.
2. Brown served as superintendent until 1859 and then as company president until his death in 1902. Acts and Resolutions of the Georgia General Assembly, 1855-1856, 426-27; "Isaac Moses was a Friend of Education," Columbus Sunday Ledger-Enquirer, (Civil War Centennial Edition), 16 April 1961, 15; Etta Balnchard Worsley, Columbus on the Chattahoochee (Columbus, 1951), 374; "A River of Romance and History." The Columbus Magazine, IV (September 30, 1943), 3, 15, 18, 19.
3. Columbus Enquirer, 13 June 1854; "Historical Notes on Columbus Iron Works and the W. C. Bradley Company" (typescript, written by the Company).
4. The Columbus Iron Works produced cannon of local fame. According to oral tradition the company cast the "Red Jacket" (22 inch long with a 2 inch bore for the Columbus Guards which along with 500 other pieces saluted Jefferson Davis at his inauguration. The "Ladies Defender" (53 inch long with a 4 1/2 inch bore) was cast from brass collected by the ladies of Columbus. A company employee Captain William J. McAllister, a steamboat captain and later an engineer for the Eagle and Phenix Mills, fabricated a breech loading cannon out of the shaft of the steamboat John C. Calhoun. The weapon broke during test firing in 1863 and was declared a failure by its maker. Company historians proclaim it the "first" breech loading canon, even though such devices existed since the 14th century. McAllister produced the weapon just for the sheer fun of it and only made one. The C.S.A. Navy used no such weapons, but the cannon does indicate the technical skill of McAllister and his colleagues. The Columbus Enquirer quoted, and the reminiscences of George Burrus, who saw the breech-loading cannon, quoted in Major Leighton G. Morey, Captain Leo D. Weltsch, Captain John E. Tyler, and First Lieutenant Howard E. Phillips, "Brief History of the Columbus Iron works, 1853-1865." (typescript, paper written for history class of Dr. Joseph Mahan at the University of Georgia extension in Columbus, March 5, 1957); Diffie William Standard, Columbus, Georgia in the Confederacy, The Social and Industrial Life of the Chattahoochee River Port (New York, 1954), 39-45; Interview with Robert Holcombe, Curator, Confederate Naval Museum, Columbus, Georgia, August 19, 1977. Holcombe has searched the C.S. Naval Iron Works and the Naval Yard more than any other historian and represents the best source on their development and production. See O. F. G. Hogg. Artillery: Its Origin, Heyday and Decline (London, 1970), facing p. 116, for a picture of "two breech-loading cannons dating from about the end of the fourteenth century."

5. Standard, Columbus . . . in the Confederacy, 39-45.
6. Several accounts, including Standard, assert that the Iron Works continued to cast cannons, but Holcombe believes it completely converted to the production of steam engines and boilers. Some sources confuse the production of the Columbus Arsenal with that of the Iron Works. The cannons for the gunboats made in Columbus were cast in Selma, Alabama. Ibid.; Morey, et al., "Brief History of the Columbus Iron Works;" Interview with Bob Holcombe.
7. Examination of existing engine parts at the Confederate Naval Museum by Robert Holcombe; copies of James Warner's installation drawings, Confederate Naval Museum; Official Records of Union and Confederate Navies, Sec. 2, I, 266, 251, XVI, 373. (hereafter cited ORN)
8. CCS Chattahoochee, CCS Savannah, CSC Jackson, CSS Tsucaloosa, CSS Huntsville, CSS Columbus, CSS Wilmington, CSS Macon, CSS Viper, CSS Milledgeville, 2 other boats in the Milledgeville class, 2 light draft ironclads, and the steamboat Shamrock. List compiled by Robert Holcombe.
9. Warner reported to the Chief of the Naval Engineering Department. Warner's letterbook and copies of McLoughlin's correspondence, Confederate Naval Museum; Interview with Robert Holcombe; Standard, Columbus . . . in the Confederacy, 39-45.
10. As a result of the mobilization, Warner received the rank of Major in the state militia. Ironically, Warner was sick and did not accompany the troops. In correspondence he signed his rank as Chief Engineer. Oral tradition always refers to "Major" Warner and in part that explains why it appeared as if he commanded Lieutenant McLoughlin. In fact, McLoughlin's Navy lieutenancy was equivalent to an army Major and the Navy rank of Chief Engineer. Ibid.; 13 April 1965, Confederate Naval Museum. The Union Post Commander, Brig. General (Breult) E. F. Winslow, made the following inventory:

"Naval Armory: One small rolling-mill in operation - 1 engine, 40-horsepower; 1 blast engine, 8-horsepower; 2 sets of rollers, and 3 furnaces, capable of making 4,000 pounds of iron per day. One new rolling-mill nearly completed - one 150-horsepower engine, intended to roll railroad and boiler-plate iron; 3 large furnaces; 1 blast engine, 10-horsepower; one 10-horsepower steam hammer. This building was 150 feet square. One machine shop - 2 engines, 45-inch cylinder, nearly completed; 160 feet shafting; 3 small and 2 large planers; 16 iron lathes; 1 large lathe; 7 feet face plate; 3 drill presses; 30 vises; 15,000 pounds brass. All lathes and planers had full sets of tools. One blacksmith shop, containing 10 forges. Several offices and drawing rooms, with their contents. One pattern-shop, with 3 wood turning lathes and 1 woodplaner. Foundry, boiler-shop, copper, shop, and their contents.

Navy-Yard: . Containing brass foundry, boat-building house, and 1 machine shop, with hot-air furnace; 1 engine, 8-horsepower; 1 large planer; 1 rip-saw and drill press; 5,000 rounds of large ammunition; also 1 blacksmith shop and tools." ORN See 1, XLIX, 1, 486.

11. Warner was killed by a stray bullet fired by black federal troops during a conflict with local whites. Samuel J. Whiteside, another wartime subordinate, became the chief figure in the Central Steamboat Line of Columbus. Columbus Daily Sun, 7, 22, 23 February 1866; Columbus Enquirer-Sun, 28 July 1880 The Columbus Magazine, IV September 30, 1943), 3, 8.
12. Columbus Enquirer Extra, June 2, 1865 (advertisement dated May 19); City Foundry (Port, McIlhenny and Co.), Columbus Daily Sun, September 1, 1865; Phoenix Foundry and Machine Shop (L. Haiman and Co.), Columbus Daily Enquirer, October 5, 1865; Georgia Iron and Nail Works, Columbus Daily Sun, January 27, 1866; Goetchius and England's Steam Planing Mill (built steam engines in its machine shop), Columbus Daily Sun, April 5, 1866; John McIlhenny selling his foundry, Columbus Daily Enquirer, April 27, 1866; Booker, Fee and Co. (tin, sheet iron and copper ware), Columbus Daily Sun, January 29, 1867; Phoenix Iron Works (Port and Fell Co.), Columbus Daily Sun, January 8, 1868; Georgia Iron Works (Porter and Fell), Columbus Daily Enquirer, March 25, 1869; Thomas Gilbert Scrapbook, Gilbert Collection, Special Collections, University of Georgia; J. C. Porter (agricultural machinery), Columbus Sunday Enquirer, July 23, 1876.
13. CIW probably produced hollow ware but did not mention it in its early ads. Columbus Daily Sun, 31 August 1865, 1 April, 20 May 1866, 31 March 1870; Columbus Daily Enquirer, 21 November 1865, 22 August 1868.
14. Sanborn Insurance Maps and Columbus, Georgia, 1885, 1889, 1895, 1900; Columbus Daily Sun, 1 April 1866; Columbus Daily Enquirer Sun, 5 October 1876, 29 December 1877; Manuscript Census Returns, tenth Census, 1880, Manufacturers, Table V; "List of Patterns of Columbus Iron Works, Columbus, Georgia." Undated, Thomas Gilbert Scrapbook. Special Collections, University of Georgia (Even though not dated this pamphlet must have been published in the 1870s since it does not mention the ice machine.)
15. Ibid.; Columbus Daily Sun, 31 March 1870; Ledger Books of Columbus Iron Works, 1876, 1877, 1878, 1879, 1880, 1881, 1897, in storage in 901 Front Street.

16. Ibid.; Industry of Columbus, 1887, (Columbus, 1887).
17. The Rebecca Everingham burned in 1884 -- the worst tragedy on the river: The Columbus Magazine, IV (September 30, 1943), 10-13. A large broken rudder for a steamboat was sent from Savannah to the Columbus Iron Works for the company to cast a new one. Columbus Daily Sun 15 August 1867, 15 May 1870; Columbus Daily Enquirer, 22 August 1868, 10 September 1870; Charles H. Fitch, "Report on Marine Engines and Steam Vessels in the U.S. Merchant Service," In Tenth Census, 1880, 43. Charles H. Fitch, "Report of the Manufacture of Engines and Boilers," in 10 Census, 1880, Report on Manufacturing.
18. On 13 December 1865 the Enquirer informed Columbusites that "the success in ice manufacturing in other Southern cities is such as to remove all doubts from the minds of our citizens of its practicability." The Daily Sun (11 August 1868) wrote Columbus would soon have an ice factory in operation. "So, Mr. Macon, you will perceive your sister city is not far behind you in the good work." Columbus Daily Sun, 12 December 1865, 18 January 1866; Columbus Daily Enquirer 4 January 1866.
19. The Muhl machine had the advantage of being a safer machine than its chief rival, the Carre. The Muhl operated at 40-60 pounds per square inch, while the Carre developed 210-250 pounds per square inch. Oscar Edward Anderson, Jr., Refrigeration in America, A History of a New Technology And Its Impact (Princeton, 1953), 86-96; "Historical Review of the Rise of Mechanical Refrigeration," Ice and Refrigeration, January 1902, 13-14; Columbus Daily Sun 15 May, 20, 21, September 1872; Columbus Daily Enquirer 4 July 1874.
20. Ice and Refrigeration, January 1902, 13-14; Anderson, Refrigeration in America, 68, 95.
21. Ibid.
22. Ibid.; Industry of Columbus, 1887.
23. The compression system was considered an advancement over the absorption met had, and had been marketed decades before introduced into the CIW product line. Ice and Refrigeration, January 1902, 13-14; Anderson. Refrigeration in America, 95; Advertisement of Columbus Iron Works, Ice & Refrigeration, June 1900, 528; Box of contracts for installing ice machines in 901 Front Street Building.
24. In 1903 and 1904 a 5-ton machine installed in Mississippi cost \$4,400; a 10 ton in Virginia \$7,150; a 15 ton in Illinois \$12,000; 30 ton in New Jersey \$18,763; and a 100 ton in Atlanta sold for \$45,500; prices varied depending on much materials and labor the purchaser provided. Box of contracts, Columbus Iron Works.

25. C. T. Baker, "Twenty-Five Years of Ice Manufacture in the South," Southern Power Journal, XLVII (June 1929), 120-143.
26. The Columbus Enquirer, 29 March, 16 April 1902 "Historical Notes on Columbus Iron Works and the W. C. Bradley Company."
27. Sanborn Insurance Maps of Columbus, Georgia, 1907, 1929.
28. Interview with Charles Tidman, Vice-President of Columbus Iron Works from 1930 to the 1960s, conducted by John Lupold and Barbara Kimmelman, June 1977.
29. Ibid., and interview with Fred Douglas, Vice-President in charge of the Forge Operation, and Manning Culpepper, Vice-President of Manufacturing Sales, of the W. C. Bradley Company. Interview conducted by John Lupold, Barbara Kimmelman, and J. B. Karfunkle, June 1977.
30. Interview with Cephus Thomason, an engineer who has been with the Columbus Iron Works since 1927 and presently is superintendent of maintenance at the W. C. Bradley Forge. Interview conducted by John Lupold, J. B. Karfunkle, and Barbara Kimmelman, June 1977. Mr. Thomason states that in the early years, power house attendants kept the Corliss engine and entire room in spotless condition. Columbusites drove by the open doors along Bay Street to observe the gleaming brass on the churning engine.
31. Inspection of the remaining buildings; Sanborn Insurance Map of Columbus, Georgia, 1907.
32. Thomason interview; Sanborn Map, 1929.
33. The following electrical equipment still remains in the power house; D. C. Generator (motor-generator unit) Commercial Electric Company, Indianapolis, Indiana #4158, 250 volts, 600 amps at 525 rpm.

General Electric Synchronous Motor #304873, 15, 350085-6 form FB Type A Q I 10-255, 60 cycles, 2 phase at 720 r.p.m. Amps 58 volts 2200, horsepower output with a power factor of 1.0 is 320. Patent 14 August 1900, 2 April 1901.

Motor (on motor-generator unit) direct connected to D.C. generator #G29057, type 1-14-50A-514 Form K, 60 cycles, 68 Amp. 440 volt, 514 r.p.m. speed no load, 490 r.p.m. speed full load, Pat. 13 August 1865, 15 August 1899, 2 December 1902.

Induction Motor belted to air compressor, General Electric, #1510471, type KQ 356 8 75 900, 60 cycles, 3 phase (removed from 2 phase) 440 volts, 40 Amps, 75 hp continuously; 25% overload for 2 hours. Patent 4 July 1916.

Switchboard includes: 2 Western Ameters No. 37779 with patents: 6 November 1888 - 22 March 1896, 1 Western Voltmeter.

34. "Historical Notes on Columbus Iron Works." A 1921 catalogue of the Southern Plow Company indicated the range of its products at that time: 28 different styles of complete plows, 3 types of cotton scrapers, 3 fertilizer spreaders, 5 cotton planters, 8 harrows and cultivators, 14 plow stocks, 2 hay pressers, 12 plow singe - and double trees, 99 different types of plow points or attachments (shovel blades, sweeps, scrapers, breacher blades, scotters, and tongues), and 8 different cane mills. The Company continued to make cane mills through the 1950s.
35. Interview with D. Abbott Turner, Chairman of the Board, W. C. Bradley Company, conducted by John Lupold, 17 June 1977; Douglas and Culpepper interview.
36. Ibid.; Tidman interview.
37. "Historical Notes on Columbus Iron Works;" Tidman, Culpepper and Douglas, and Turner interviews.
38. Inspection of the new manufacturing facilities at Bradley Park; Tidman interview.

Bibliography

Manuscript Sources:

Columbus Iron Works Records. The only available records were a broken collection of ledger and accounting books 1876-1897 that indicated the types of products sold and the customers.

James Warner Papers and Related materials, Confederate Naval Museum, Columbus, Georgia. This is the best single collection of material relating to the activities of the C.S. Navy in Columbus during the Civil War. Collected by Robert Holcomber, curator of the Naval Museum, they include the letterbook and drawings of Warner, copies of his other correspondence and that of McLoughlin, and also includes copies of pertinent orders and letters; the originals of which are held at the National Archives, Washington, D.C.

Secondary Sources

Oscar Anderson, Jr. Refrigeration in America, A History of A New Technology and Its Impact. Princeton, 1953; C. T. Baker, "Twenty-five years of Ice Manufacture in the South, Southern Power Journal" XLVII (June 1929); 130-43; "Historical Review of the Rise of Mechanical Refrigeration," Ice and Refrigeration, January 1902, 13 - 19, all contain specific references to the historical importance of the ice machines produced by the Columbus Iron Works.

"Historical Notes on Columbus Iron Works and the W. C. Bradley Company." Four page typescript written by the company.

Interviews

Manning Culpepper, Vice-President of Manufacturing Sales, and Fred Douglas, Vice President of the Forge, W. C. Bradley Company. They were interviewed simultaneously and provided the interviewers a tour of the former Columbus Iron Works buildings, June 1977. Gave general material about the overall history and valuable specific information about the changes since World War II.

Cephus, Thomason, an engineer with the Columbus Iron Works since 1927 and presently superintendent of maintenance of the forge operation, W. C. Bradley Company. His excellent memory offered a complete history of the power house and the evolution of power utilization.

Charles Tidman, Vice-President of Columbus Iron Works, 1930s-1960s provided an excellent discription of the process within the foundry and other areas of the operation. D. Abbott Turner, Chairman of the Board, W. C. Bradley Co.

All of these interviews were conducted by John Lupold, Barbara Kimmelman, and J. B. Karfunkle. The tapes are housed in the Columbus College Archives.